INTERNATIONAL STANDARD

ISO 13565-2

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Geometrical Product Specifications (GPS) — Surface texture: Profile method; Surfaces having stratified functional properties —

Part 2:
Height characterization using the linear material ratio curve

Spécification géométrique des produits (GPS) — État de surface: Méthode du profil; surfaces ayant des propriétés fonctionnelles différentes suivant les niveaux —

Partie 2: Caractérisation des hauteurs par la courbe de taux de longueur portante

Reference number
ISO 13565-2:1996(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 13565-2 was prepared jointly by Technical Committees ISO/TC 57, *Metrology and properties of surfaces,* Subcommittee SC 1, *Geometrical parameters — Instruments and procedures for measurement of surface roughness and waviness,* ISO/TC 3, *Limits and fits* and ISO/TC 10, *Technical drawings, product definition and related documentation,* Subcommittee SC 5, *Dimensioning and tolerancing.*

ISO 13565 consists of the following parts, under the general title *Geometrical product specifications (GPS) — Surface texture: Profile method; Surfaces having stratified functional properties*:

— *Part 1: Filtering and general measurement conditions*

— *Part 2: Height characterization using the linear material ratio curve*

— *Part 3: Height characterization using the material probability curve*

Annexes A and B of this part of ISO 13565 are for information only.

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Introduction

This part of ISO 13565 is a Geometrical Product Specification (GPS) standard and is to be regarded as a *General GPS standard* (see ISO/TR 14638:1995). It influences chain link 2 of the chain of standards for roughness profile.

For more detailed information of the relation of this part of ISO 13565 to other standards and the GPS matrix model, see annex A.

This part of ISO 13565 defines a set of parameters, based on the linear material ratio curve, to be used for the evaluation of the valley suppressed roughness profile defined in ISO 13565-1. It is based on a three-layer surface model, evaluating the peaks, the core and the valleys separately.

Geometrical Product Specification (GPS) — Surface texture: Profile method; Surfaces having stratified functional properties —

Part 2:
Height characterization using the linear material ratio curve

1 Scope

This part of ISO 13565 describes the evaluation process for determining parameters from the linear representation of the material ratio curve (also referred to as the Abbott curve) which describe the increase of the material portion of the surface with increasing depth of the roughness profile. They are intended to aid in assessing the operational behaviour of highly mechanically stressed surfaces.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 13565. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 13565 are encouraged to investigate the possibility of applying the most recent editions of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1302:1992, *Technical drawings — Method of indicating surface texture.*

ISO 4287:1996, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters.*

ISO 13565-1:1996, *Geometrical Product Specifications (GPS) — Surface texture: Profile method; Surfaces having stratified functional properties — Part 1: Filtering and general measurement conditions.*

3 Definitions

For the purposes of this part of ISO 13565, the definitions given in ISO 4287:1996, 3.1, and the following definitions apply.

3.1 roughness core profile: Roughness profile excluding the protruding peaks and deep valleys (see figure 1).

3.1.1 core roughness depth, *Rk*: Depth of the roughness core profile (see figure 1).

3.1.2 material portion, *Mr*1: Level, in percent, determined for the intersection line which separates the protruding peaks from the roughness core profile.

3.1.3 material portion, *Mr*2: Level, in percent, determined for the intersection line which separates the deep valleys from the roughness core profile.

3.2 reduced peak height, *Rpk*: Average height of the protruding peaks above the roughness core profile.

NOTE — The averaging process in clause 4 reduces the effect of outlier values on this parameter.

3.3 reduced valley depths, *Rvk*: Average depth of the profile valleys projecting through the roughness core profile.

NOTE — The averaging process in clause 4 reduces the effect of outlier values on this parameter.

4 Determination of parameters

4.1 Roughness profile

The roughness profile used for determining the parameters which are the subject of this part of ISO 13565 shall be calculated according to ISO 13565-1.

4.2 Calculating the parameters *Rk*, *Mr*1, *Mr*2

The equivalent straight line, calculated according to 4.3, intersects the abscissae $Mr = 0$ % and $Mr = 100$ % (see figure 1). From these points two lines are plotted to the x-axis, which determine the roughness core profile by separating the protruding peaks and valleys.

The vertical distance between these intersection lines is the core roughness depth *Rk*. Their intersections with the material ratio curve defines the material ratios *Mr*1 and *Mr*2.

4.3 Calculating the equivalent straight line

The equivalent straight line is calculated for the central region of the material ratio curve which includes 40 % of the measured profile points. This "central region" lies where the secant of the material ratio curve over 40 % of the material ratio shows the smallest gradient (see figure 1). This is determined by moving the secant line for $\Delta Mr = 40$ % along the material ratio curve, starting at the $Mr = 0$ % position as in figure 1. The secant line for $\Delta Mr = 40$ % which has the smallest gradient establishes the "central region" of the material ratio curve for the equivalence calculation. If there are multiple regions which have equivalent minimum gradient, then the one region that is first encountered is the region of choice. A straight line is then calculated for this "central region" which gives the least square deviation in the direction of the profile ordinates.

NOTE — To ensure the validity of the material ratio curve, the class widths of ordinates of the roughness profile should be selected to be small enough for at least 10 classes to fall within the "central region". With surfaces having very small roughness or having an almost ideal geometrical plateau, such a fine classification may no longer be meaningful, because of the limited resolution of the measuring system. In this case the number of classes used in the calculation of the equivalent straight line should be stated in the test results.

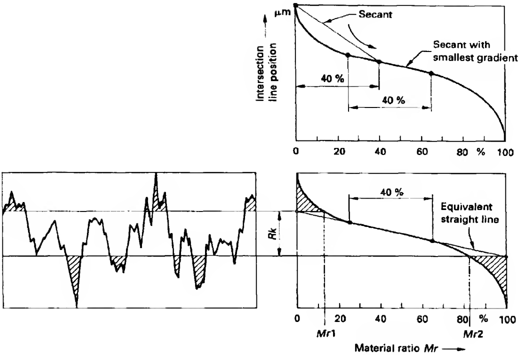

Figure 1 — Calculation of *Rk*, *Mr*1 and *Mr*2

4.4 Calculating the parameters *Rpk* and *Rvk*

The areas above and below the region of the material ratio curve which delimits the core roughness *Rk* are shown hatched in figure 1. These correspond to the cross-sectional area of the profile peaks and valleys which protrude out of the roughness core profile.

The parameters *Rpk* and *Rvk* are each calculated as the height of the right-angle triangle which is constructed to have the same area as the "peak area" or "valley area" respectively (see figure 2). The right-angle triangle corresponding to the "peak area *A*1" has *Mr*1 as its base, and that corresponding to the "valley area *A*2" has 100 % — *Mr* 2 as its base.

NOTE — The parameters according to this part of ISO 13565 should only be calculated if the material ratio curve is "S" shaped as shown in figures 1 and 2 and thus has only one single point of inflection. Experience has shown that this is always the case for lapped, ground or honed surfaces.

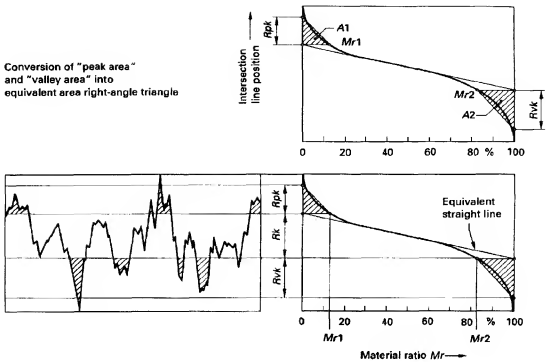

Figure 2 — Calculation of *Rpk* and *Rvk*

5 Parameter specification on drawings

The parameters in this part of ISO 13565 shall be specified on engineering drawings according to ISO 1302.

Annex A
(informative)

Relation to the GPS matrix model

For full details about the GPS matrix model, see ISO/TR 14638.

A.1 Information about this part of ISO 13565 and its use

This part of ISO 13565 defines a set of parameters, based on the linear material ratio curve, to be used for the evaluation of the valley suppressed roughness profile defined in ISO 13565-1. It is based on a three-layer surface model, evaluating the peaks, the core and the valleys separately.

The parameters are intended to aid in assessing the operational behaviour of highly mechanically stressed surfaces. The roughness profile used for determining these parameters shall be calculated according to ISO 13565-1.

A.2 Position in the GPS matrix model

This part of ISO 13565 is a *General GPS standard*, which influences the chain link 2 of the chain of standards for roughness profile in the *General GPS matrix*, as graphically illustrated in figure A.1.

Fundamental GPS standards

Global GPS standards

General GPS matrix						
Chain link number	**1**	**2**	**3**	**4**	**5**	**6**
Size						
Distance						
Radius						
Angle						
Form of line independent of datum						
Form of line dependent on datum						
Form of surface independent of datum						
Form of surface dependent on datum						
Orientation						
Location						
Circular run-out						
Total run-out						
Datum planes						
Roughness profile						
Waviness profile						
Primary profile						
Surface defects						
Edges						

Figure A.1

A.3 Related standards

The related International Standards are those of the chains of standards indicated in figure A.1.

Annex B
(informative)

Bibliography

[1] ISO 3274:1996, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Nominal characteristics of contact (stylus) instruments.*

[2] ISO 4288:1996, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture.*

[3] ISO 11562:1996, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Metrological characteristics of phase correct filters.*

[4] ISO 12085:1996, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Motif parameters.*

[5] ISO/TR 14638:1995, *Geometrical Product Specifications (GPS) — Masterplan.*

[6] *VIM — International vocabulary of basic and general terms in metrology.* BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML, 2nd edition, 1993.

ICS 17.040.20

Descriptors: surface properties, surface condition, determination, characteristics, texture profiles, roughness measurement, rules of calculation, geometrical product specifications.

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